

LISTING OF THE CLAIMS

The following list of claims will replace all prior versions and listings of claims in the application:

1 (Currently amended): A method for fabricating microneedles, said method comprising:

(a) providing a substrate material;

(b) coating said substrate material with ~~at least one~~ a first layer of a photoresist material;

(c) coating said first layer of photoresist material with a second layer of photoresist material;

(d) [[, and]] patterning said second layer of photoresist material photoresist material with a plurality of microstructures by use of a photolithography procedure; and

[[(c)]] (e) separating said patterned first and second layer of photoresist material from said substrate material, thereby creating a microneedle structure comprised of said patterned photoresist material containing said plurality of microstructures.

2 (Previously presented): The method as recited in claim 1, wherein said microneedle structure comprises one of: (a) a plurality of solid protrusions, (b) a plurality of hollow protrusions forming through-holes, or (c) a plurality of hollow protrusions forming microcups that do not extend entirely through said patterned photoresist material.

3 (Original): The method as recited in claim 1, wherein said photoresist material comprises a first layer and a second layer, said first layer being cured before said second layer is applied, and said second layer being patterned by said photolithography procedure.

4 (Original): The method as recited in claim 1, further comprising: applying a layer of acid-dissolvable material between said substrate and said photoresist material at the commencement of said method, and during said step of separating the patterned photoresist material from the substrate, dissolving said acid-dissolvable material as a sacrificial layer.

5 (Original): The method as recited in claim 4, wherein said substrate comprises one of a silicon or a metallic substance, said photoresist material comprises SU-8, and said acid-

dissolvable material comprises one of PDMS or silicon oxide.

6 (Original): The method as recited in claim 4, further comprising: creating break-away microneedles by briefly etching a portion of said plurality of microstructures proximal to a junction between a base structure and protrusions of the patterned photoresist material containing said plurality of microstructures, said base structure and said microstructure protrusions both being constructed of said photoresist material.

7 (Currently amended): The method as recited in claim 1,
wherein ~~said photoresist material comprises at least two individual layers, a~~ the first of said ~~at least two individual~~ photoresist layers being patterned with a first plurality of openings that are of a first size, ~~[[a]] the second of said at least two individual~~ photoresist layers being patterned with a second plurality of openings that are of a second size that is larger than said openings of said first size, said first and second plurality of openings being substantially in alignment with one another; and after said separation of the substrate from the patterned photoresist material, said plurality of microstructures comprises a plurality of microneedles having sharp tips.

8 (Original): The method as recited in claim 1, wherein said microneedle structure comprises a plurality of individual microneedles that have an aspect ratio of at least 3:1.

9 (Original): A method for fabricating microneedles, said method comprising: (a) providing a substrate material; (b) coating said substrate material with at least one layer of a photoresist material, and patterning said photoresist material with a plurality of microstructures by use of a photolithography procedure; and (c) coating said patterned photoresist material with a layer of moldable material that takes the negative form of said plurality of microstructures, and allowing said moldable material to harden using a soft lithography procedure, then separating said hardened moldable material from both said patterned photoresist material and said substrate material.

10 (Cancel)

11 (Original): A method for fabricating microneedles, said method comprising: (a) providing a substrate material; (b) coating said substrate material with at least one layer of a photoresist material, and patterning said photoresist material with a plurality of microstructures by use of a photolithography procedure; (c) applying a first moldable material onto said patterned photoresist material/substrate and allowing said first moldable material to harden using a soft lithography procedure, then separating said hardened first moldable material from said patterned photoresist material/substrate to thereby create a microstructure; and (d) applying a second moldable material onto said microstructure, and after hardening of said second moldable material, separating said hardened second moldable material from said microstructure, thereby creating a microneedle structure from said hardened second moldable material having the three-dimensional negative form of said microstructure.

12 (Original): The method as recited in claim 11, wherein said microneedle structure comprises one of: (a) a plurality of solid protrusions, (b) a plurality of hollow protrusions forming through-holes, or (c) a plurality of hollow protrusions forming microcups that do not extend entirely through said hardened second moldable material.

13 (Original): The method as recited in claim 12, further comprising a polishing or grinding procedure to open one end of said plurality of microcups, thereby creating a plurality of hollow protrusions forming through-holes.

14 (Previously presented): The method as recited in claim 11, further comprising the step of applying an electrically conductive substance through a mask onto a surface of said microneedle structure, thereby creating at least one pattern of electrically conductive pathways on said surface.

15 (Original): The method as recited in claim 9, further comprising: hardening a tip of a plurality of microneedles formed of said microstructures.

16 (Original): The method as recited in claim 15, wherein said tip is hardened by adding carbon fibers, or by adding a composite material.

17 (Original): The method as recited in claim 9, further comprising: applying said plurality of microneedles to skin, wherein said plurality of flexible microneedles breaks away from a base structure of said microstructures and thereby remaining within a stratum corneum of said skin after said base structure is removed, and wherein said plurality of flexible microneedles are hollow; applying at least one time a liquid through said plurality of flexible hollow microneedles and thereby through said stratum corneum; and leaving said flexible hollow microneedles in said stratum corneum over a time duration.

18-21 (Cancelled)

22 (Currently amended): A method for fabricating microneedles, said method comprising: (a) providing a substrate comprising a base and a plurality of microstructures; (b) applying a first moldable material onto said patterned substrate and allowing hardening by soft lithography said first moldable material ~~to harden~~, then separating said hardened first moldable material from said patterned substrate to thereby create a microstructure; (c) applying a second moldable material onto said microstructure, and after hardening of said second moldable material by soft lithography, separating said hardened second moldable material from said microstructure, thereby creating a microneedle structure from said hardened second moldable material having the three-dimensional negative form of said patterned substrate and so comprising a second base and a second plurality of microstructures; (d) creating break-away microneedles by etching a portion of said second plurality of microstructures proximal to a junction between said second base and said second plurality of microstructures.

23 (Currently amended). A method for fabricating microneedles, said method comprising: (a) providing a substrate comprising a base and a plurality of protrusions; (b) applying a first moldable material onto said patterned substrate and allowing hardening by soft lithography said first moldable material ~~to harden~~, then separating said hardened first moldable material from said patterned substrate to thereby create a microstructure; (c) applying a second

moldable material onto said microstructure, and after hardening of said second moldable material by soft lithography, separating said hardened second moldable material from said microstructure, thereby creating a microneedle structure from said hardened second moldable material having the three-dimensional negative form of said patterned substrate and so comprising a second base and a second plurality of protrusions; (d) applying an electrically conductive substance through a mask onto a surface of said microneedle structure, thereby creating at least one pattern of electrically conductive pathways on said surface.

24 (Previously presented). The method of claim 23, wherein said electrically conductive pathways each are sized and positioned so as to cover an area upon said surface that is larger than a spacing between at least two of said plurality of protrusions, thereby creating at least one electrode band.

25 (Previously presented). The method of claim 23, wherein said electrically conductive pathways each are sized and positioned so as to cover an area upon said surface that is smaller than each of said plurality of protrusions, thereby creating a plurality of electrically isolated electrodes, such that at least one such electrode corresponds to a single one of said plurality of protrusions.

26 (Withdrawn). An array of break-away microneedles comprising a substrate comprising a first material and microneedles comprising a second material, wherein a difference in material properties between the substrate and the microneedles leads to the microneedles breaking away from the substrate upon application into the stratum corneum of skin, leaving behind multiple microneedles in the stratum corneum once the substrate is removed.